

Cyclo hexyl isocyanate

CAS # 3173-53-3

Test plan justification

Cyclohexyl isocyanate reacts with substances which contain active H atoms, such as water, acids, alkaline solutions, ammonia, primary and secondary **amines**, alcohols, mercaptans, and phenols. A reaction with water causes CO₂ to split off and symmetrical di-cyclohexyl urea to form, amongst other products. Catalytically acting compounds such as tertiary **amines**, phosphines, some metals and metal salts can cause cyclohexyl isocyanate to react with itself, forming dimers and trimers. During processing, CHI reacts completely (usually with **amines**) to create the desired product.

Because of the exceptional reactivity of CHI, there are strict operating procedures for production, storage, transport, and processing including the use of closed apparatus and fixed pipelines constructed of specific materials.

Cyclohexyl isocyanate is stored under controlled conditions and there is limited, controlled transport. It is therefore classified as a "closed system intermediate". In this regard, limited testing is required: no Repeat dose toxicity or Reproductive Toxicity testing is warranted.

Physicochemical properties:

The properties of cyclohexyl isocyanate can be found in Handbooks such as CRC Handbook of Chemistry and Physics and have been documented by Bayer AG. Although original documents are not available for all endpoints, no additional testing is proposed. (See attached IUCLID document)

Environmental Fate:

Photodegradation and Fugacity were modeled using the EPIWIN Program, as recommended by the HPV Challenge Guidance. An OECD Guideline study of biodegradation was performed on cyclohexyl isocyanate, and summarized in the attached UCLID document.

The rapid hydrolysis of isocyanates in water is known, however no study was located on cyclohexyl isocyanate. It is proposed to determine the rate of hydrolysis along with degradation products of cyclohexyl isocyanate using OECD 111. This data will also aid in the ecotoxicity endpoints.

Ecotoxicology:

Isocyanates are believed to hydrolyze to the associated amine (i.e. cyclohexylamine). The OECD 11 1 study will confirm the degradation product. Since there are many studies on fish, Daphnia and algae using cyclohexylamine, it is believed that these endpoints will be filled with that data. No additional testing is proposed if cyclohexylamine is the rapid degradation product of cyclohexyl isocyanate in water.

Mammalian Toxicology:

There are two well documented studies on acute oral, inhalation and dermal toxicity, as summarized in the attached IUCLID.

Cyclohexyl isocyanate is a "closed system intermediate" because each of the uses is to undergo a deliberate reaction to create another substance. Cyclohexyl isocyanate is stored under controlled conditions and there is limited controlled transport. In this regard, limited testing is required. Therefore no Repeat dose toxicity or Reproductive Toxicity testing is warranted.

There are no studies to fill the Mutagenicity endpoints, therefore OECD 471 and 473 are proposed.

To fulfill the Developmental Toxicity endpoint, required even though there is limited exposure due to the chemical being an intermediate, OECD 414 is proposed.

Table 1. Test Plan for Cyclohexylisocyanate

Endpoint	Data Availability	Acceptable	Planned testing
Physical-Chemical Data			
Melting Point	-80 C	✓	
Boiling Point	172C	✓	
Vapour Pressure	2.2 hPa @ 20 C	✓	
Partition Coefficient (logP _{ow})	Not determinable - hydrolysis	✓	
Water Solubility	hydrolysis	✓	
Environmental Fate			
Photodegradation	EPIWIN	✓	
Fugacity	EPIWIN	✓	
Biodegradability	✓	✓	
Water Stability			OECD 111
Ecotoxicology			
Acute Fish Toxicity	Only LC ₀		Use CHA data*
Acute Invertebrate Toxicity			Use CHA data*
Algal Toxicity			Use CHA data*
Mammalian Toxicology			
Acute Toxicity	✓	✓	
Mutagenicity			OECD 471
Chromosome Aberration			OECD 473
Repeated Dose Toxicity			Intermediate- no testing necessary
Reproductive Toxicity			Intermediate- no testing necessary
Developmental Toxicity			OECD 414

✓ = data available and considered adequate.

* The Water Stability study will determine degradation products, believed to be cyclohexylamine (CHA). CHA has adequate data for these endpoints